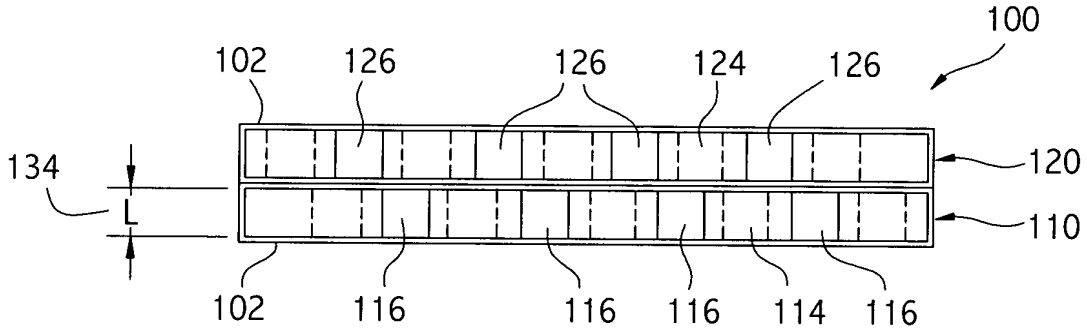
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FIG. 1

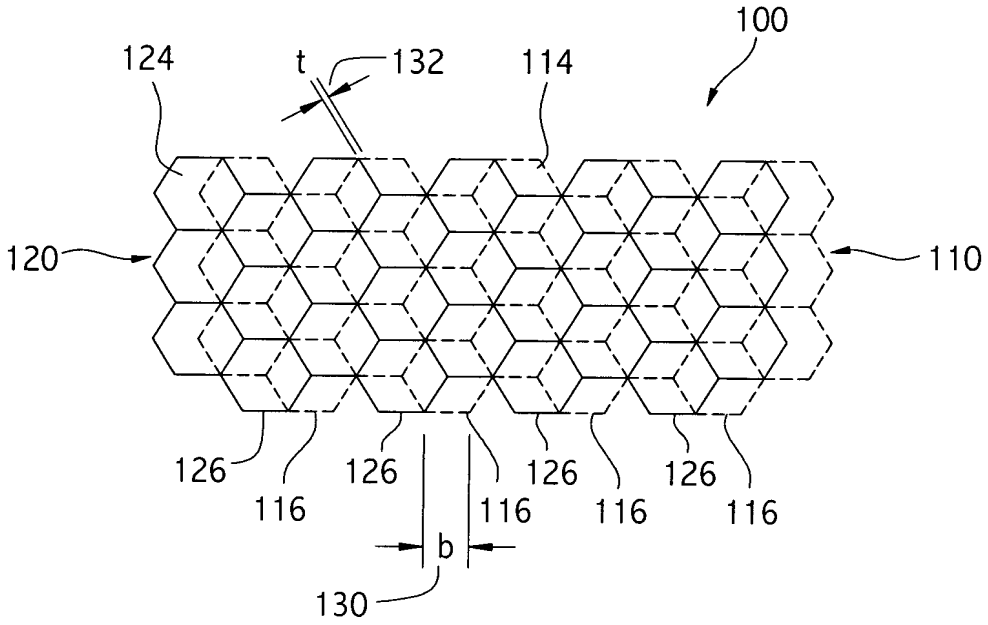
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FIG. 2

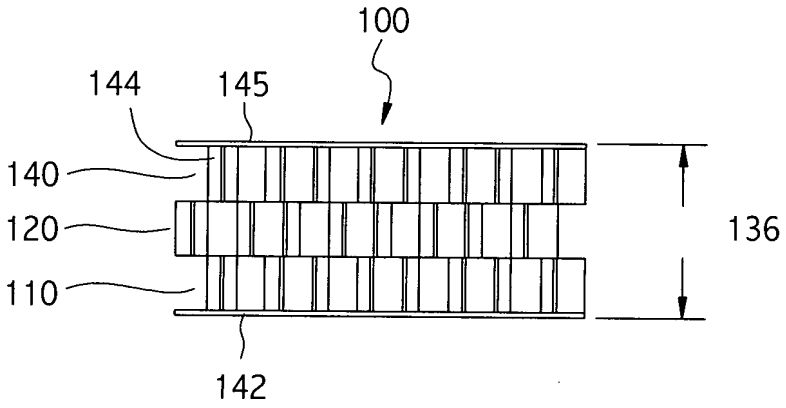


FIG. 3B

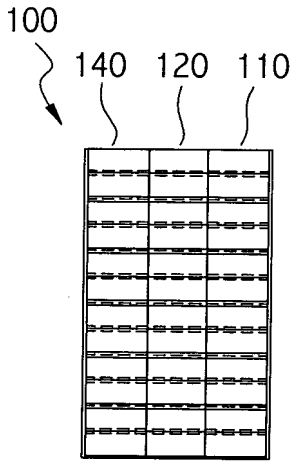


FIG. 3C

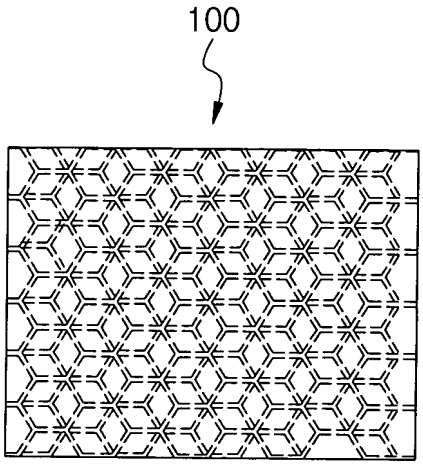


FIG. 3A

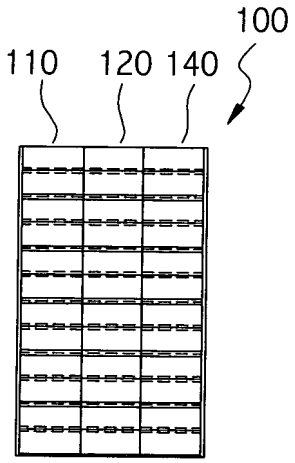


FIG. 3D

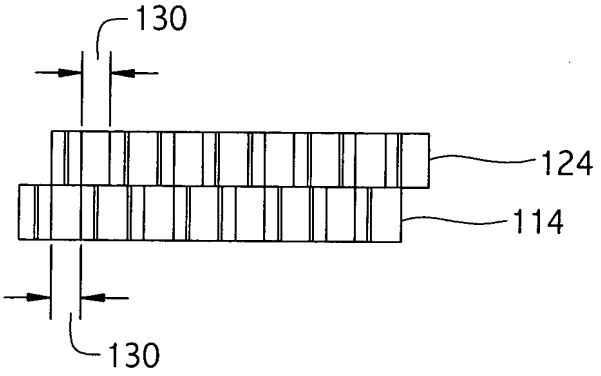


FIG. 4B

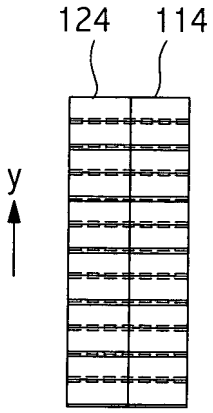


FIG. 4C

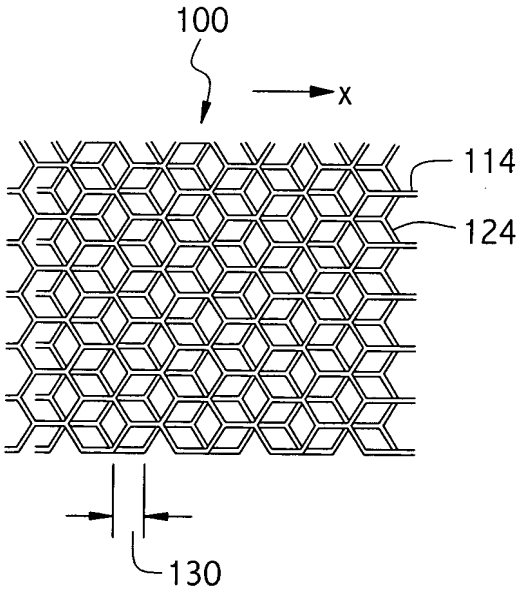


FIG. 4A

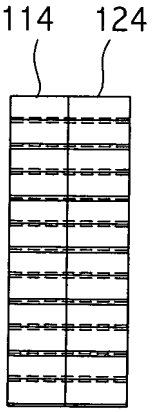


FIG. 4D

FIG. 5B

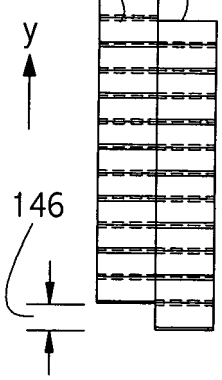


FIG. 5C

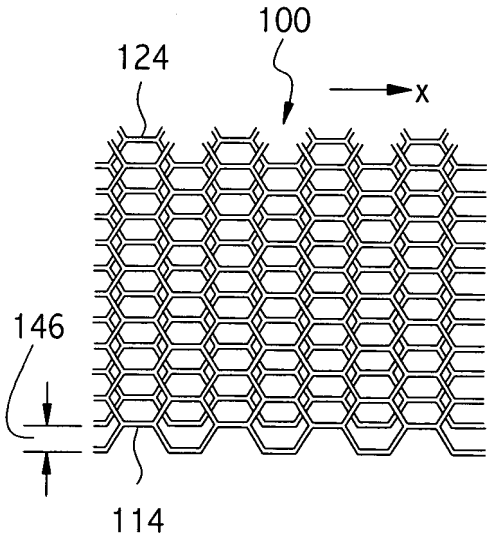


FIG. 5A

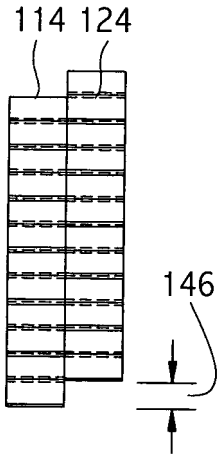
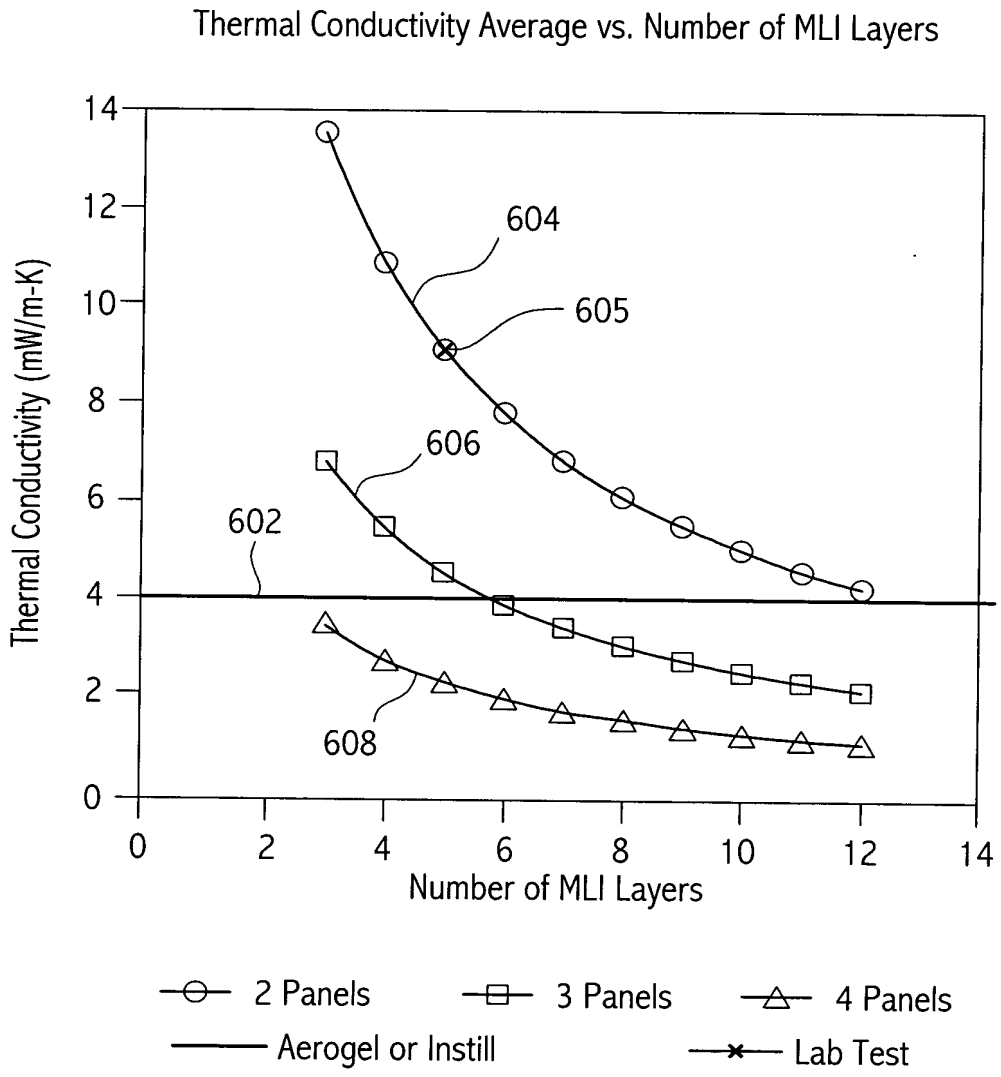
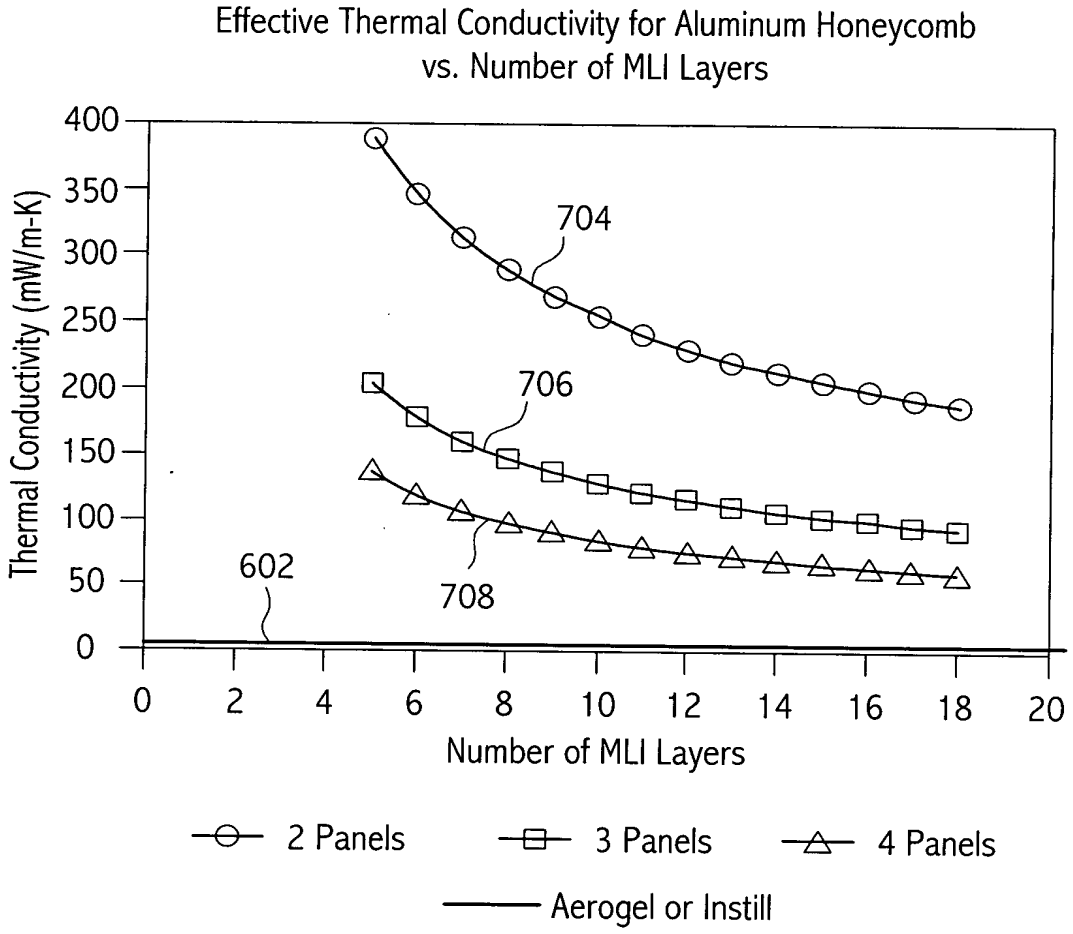


FIG. 5D



Effective Thermal Conductivity of Nomex Honeycomb Panels with Multilayer Insulation, Compared to Aerogel or Instill and to a Vacuum Test

FIG. 6



Effective Thermal Conductivity of Aluminum Honeycomb Panels with Multilayer Insulation, Compared to Aerogel or Instill

FIG. 7

FIG. 8 COMPARISON OF HEAT TRANSFER RATES FOR VARIOUS HONEYCOMB CELL CONDITIONS 800

802 Configuration	804 Wall Heat Transfer BTU/ft^2-hr	806 Air Heat Transfer BTU/ft^2-hr	808 Radiation Heat Transfer BTU/ft^2-hr	810 Total BTU/ft^2-hr	812 Effective Thermal Conductivity BTU-in/ft^2-hrF	mW/m-K
1" Thick Honeycomb Not Evacuated	3.33	8.1	20.44	31.8	0.662	95.5
1" Thick Honeycomb Evacuated	3.33	approx. 0	20.44	23.77	0.495	71.3
Two 1/2" Thick Honeycomb Cores, Each Vacuum Seated in MLI With 1 Layer MLI in Between (5 total) Emissivity=0.6, Shape Factor=0.35	0.39	approx. 0	1.58 (0.35/0.5)(0.6/0.9)(1/(5+1)20.44	1.98	0.04125	5.94
Two 1/2" Thick Honeycomb Cores, Each Vacuum Seated in MLI With 1 Layer MLI in Between (5 total) Emissivity=0.9, Shape Factor=0.5	0.39	approx. 0	3.4067 (1/(5+1)20.44	3.797	0.079	11.38
Three 1/2" Thick Honeycomb Cores, Each Vacuum Seated in MLI With 1 Layer MLI in Between (8 total) Emissivity=0.3, Shape Factor=0.2	0.208	approx. 0	0.303 (0.2/0.5)(0.3/0.9)(1/(8+1)20.44	0.511	0.000895	1.52

Note: Cell wall width = 0.5, Wall Thickness = 0.05, Thermal Conductivity of Cell Material = 0.05 BTU/ft^2-hr. Shape factor is 0.5 for a single cell, 0.35 for two offset cells, and 0.2 for three offset cells. Emissivity is estimated to be 0.9 for the face sheet material and cell. Alternatively, when vacuum sealed in MLI, emissivity is estimated to be 0.6 for an improved face sheet material for two cores, and 0.3 for three cores.